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AGRICULTURAL MEMORANDUM NO. 686

ESTIMATING HEAT LOSSES FROM GLASSHOUSES FOR DIFFERENT DAY AND NIGHT TEMPERATURE REGIMES

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1. BACKGROUND

To economise on fuel without seriously affecting the growth of the crop, many growers are now reducing glasshouse temperatures at night. In the past, ADAS advisers have estimated heat loss using the tables in Appendix II of MAFF Bulletin No.115, "Commercial Glasshouses". These tables assume that a given internal temperature is maintained throughout the twenty-four hours. To estimate the daily heat loss when there is a split day/night temperature regime, ADAS advisers have taken the number of degree-days (D or N) on the assumption that the day (D) or night (N) temperature is maintained for twenty-fours, and compounded them according to the daylength. The rule-of-thumb used has been:

November to February, daily total = $\frac{D}{3} + \frac{2N}{3}$

March to October, daily total = $\frac{D}{2} + \frac{N}{2}$

With the publication in Ag. Mem. 629 of accumulated temperatures split by day and night, it is possible to check the rule-of-thumb.

2. METHOD

Values were taken for Thorney Island (representative of the South Coast), using temperatures of 19° C by day and 13° C by night, from Ag. Mem. 629. Mr Forsdyke kindly arranged the supply of values for Manby (representative of Humberside), and at this station a regime of 19° C by day and 7° C by night was considered. The totals of accumulated temperature for the split day/night regimes were found by direct addition, and also by the rule-of-thumb, and the results are shown in tables 1 and 2. The direct addition is diagonally downwards in each small table on the left, eg for January at Thorney Island for a day temperature of 19° C and 13° C at night, the average accumulated temperature is 145 + 189 = 334° C days. The underlined total is to be compared with the short-cut method on the right, total also underlined. It will be seen that the agreement is generally quite good, and particularly so in the winter when the heat loss is greatest.

3. BASIS OF TABLES IN MAFF BULLETIN NO. 115

The source of the accumulated temperature tables in appendix II of the Bulletin if not given, but it is clear that it will depend on the stations used, the

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period of years, and the method of estimating the accumulated temperatures. It is therefore interesting to compare some of its values with those by the method of Ag. Mem. 629, where we know just what was done.

Results are given in table 3. There are some discrepancies up to about 15% of the maximum heat loss indicated.

TABLE 3. SOME ACCUMULATED TEMPERATURES FROM DIFFERENT SOURCES COMPARED

	S. Coast (Bull. 115)		Thorney Island (Ag.Mem. 629)			Yorkshire (Bull 115)		Manby (As Ag.Mem 629)	
Base temp °C	12½	18½	13	19		7½	18½	7	19
Jan	231	403	272	458		94	436	127	492
April	108	280	137	313		56	308	39	347
June	11	102	16	131		0	91	1	163

4. DISCUSSION

It appears that the rule-of-thumb for calculating heat loss under day/night split temperature regimes, has been adequate for practical purposes. For an accurate result, it may be more important to select a representative station and period of record, than to avoid this short cut. Though in future calculations will be made using accumulated temperatures divided by day and night, advice so far given using the short-cut method may be allowed to stand.

Any comments or suggestions on this paper should be referred to the author.

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TABLE 1
ACCUMULATED °C DAYS BELOW DIFFERENT BASES AT THORNEY ISLAND, NR CHICHESTER

	base temp °C	acc °C days day	night	total	
January	19	145	313	458 (D)	$\frac{D}{3} + \frac{2N}{3} = 153 + 182 = \underline{335}$
	13	83	189	272 (N)	
	19 day 13 night			<u>334</u>	
April	19	163	150	313 (D)	$\frac{D}{2} + \frac{N}{2} = \frac{313 + 137}{2} = \underline{225}$
	13	62	75	137 (N)	
	19 day 13 night			<u>238</u>	
July	19	77	54	131 (D)	$\frac{D}{2} + \frac{N}{2} = \frac{131 + 16}{2} = \underline{73}$
	13	8	8	16 (N)	
	19 day 13 night			<u>85</u>	

TABLE 2
ACCUMULATED °C DAYS BELOW DIFFERENT BASES AT MANBY, LINCS

	base temp °C	acc °C days day	night	total	
January	19	156	336	492 (D)	$\frac{D}{3} + \frac{2N}{3} = 164 + 85 = \underline{249}$
	7	35	92	127 (N)	
	19 day 7 night			<u>248</u>	
April	19	181	167	348 (D)	$\frac{D}{2} + \frac{N}{2} = \frac{348 + 39}{2} = \underline{193}$
	7	14	25	39 (N)	
	19 day 7 night			<u>206</u>	
July	19	94	69	163 (D)	$\frac{D}{2} + \frac{N}{2} = \frac{163 + 1}{2} = \underline{82}$
	7	0	1	1 (N)	
	19 day 7 night			<u>95</u>	